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EFFECTS OF GRAZING BY MACRO-AND MICROZOOPLANKTON ON TRANSFORMATIONS OF COLORED DISSOLVED ORGANIC MATTER

By
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Dr. David J. Burdige, Co-Principal Investigator

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For the period May 1, 1999 through April 30, 1999

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ONR Program Officer: Linda Chrisey

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Effects of Grazing by Macro- and Microzooplankton on Transformations of Colored Dissolved Organic Matter

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Long-term Research Objective: The Navy wishes to develop predictive models describing transformations of CDOM, an assemblage of molecules defined as those that absorb ultraviolet and visible radiation. Development of such models, however, requires a better understanding of the many processes by which CDOM is transformed. Our long-term objective is to understand water-column biological processes hypothesized to affect both the "background" signature of CDOM as well as spatial and temporal changes in CDOM.

S&T Objectives: We are engaged in a series of manipulative laboratory experiments designed to understand CDOM transformations associated with micro- and macrozooplankton grazing on phytoplankton.

Approach: Our approach is to use highly controlled laboratory experiments, principally involving cultured representatives of grazers and prey (Dobbs), and to characterize the time course of CDOM transformations using spectroscopic and chemical techniques (Burdige). The two spectroscopic techniques are optical absorption (UV/Vis) spectroscopy and fluorescence excitation-emission matrix spectroscopy (EEMS). We couple these spectroscopic measurements with molecular weight size fractionation studies to relate changes in CDOM optical properties with diagenetic transformation of DOM in general.

S&T Completed: We have conducted seven time-course experiments (Experiments #3-9) in the past fiscal year. All of these have involved macrozooplankton grazing (Dobbs). We have had difficulty in obtaining results consistent among experiments. In our experiments, we generally see an increase in total dissolved organic carbon with time, as well as an increase in humic-like fluorescence, which we use as an indicator of CDOM production (Burdige). However, to date we have been unable to distinguish between the CDOM produced by microbial decay(?) of organic matter and that produced directly by macrozooplankton grazing. In experiments #8 and #9, we have addressed this dichotomy, but the chemical analyses are not yet complete.

We presented our preliminary results at an ONR-sponsored workshop on CDOM in April, 1999 (Dobbs).

Impact / Navy Relevance: Studies of CDOM's properties, formation, and degradation are a current focus of ONR, given the Navy's present and projected needs for information about water visibility in the littoral zone. However, as we are still in the preliminary stages of this research, we haven't yet generated results having relevance to the field in general and to the Navy in particular. We anticipate that this will change shortly.

Planned Research Efforts: We will continue the macrozooplankton experiments and begin a parallel series of microzooplankton experiments.

References:

Blough N.V. and S.A. Green. 1995. Spectroscopic characterization and remote sensing of nonliving organic matter. pp. 23-45 *in* Role of nonliving organic matter in the Earth's carbon cycle. (R. G. Zepp and C. Sonntag, ed.). John Wiley & Sons.

Burdige D.J. and K.G. Gardner. 1998. Molecular weight distribution of dissolved organic carbon in marine sediment pore waters. Mar. Chem. 62:45-64.

Carder K.L., G.R. Steward, G.R. Harvey and P.B. Ortner. 1989. Marine humic and fulvic acids: Their effects on remote sensing of ocean chlorophyll. Limnol. Oceanogr. 34: 68-81.

Chen, W. and D.J. Burdige. Characterization of pore water DOM in marine sediments by fluorescence spectroscopy. EOS 79(1):OS22G and ms. in prep for Mar. Chem.

Coble P.G. 1996. Characterization of marine and terrestrial DOM in seawater using excitation-emission matrix spectroscopy. Mar. Chem. 51: 325-346.

Strom, S.L., R. Benner, S. Ziegler, and M.J. Dagg. 1997. Planktonic grazers are a potentially important source of marine dissolved organic carbon. Limnol. Oceanogr. 42: 1364-1374.

Other Sponsored Science & Technology--Dobbs:

"Influence of sedimentary and seagrass microbial communities on shallow-water benthic optical properties." Office of Naval Research, $282,775, 1 Oct 1996--30 Sep 1999.

"Protozoa population dynamics and bacterivory in groundwater at the DOE site in Oyster, Virginia." Department of Energy subcontract through Pacific Northwest Laboratories, $99,701, 15 Mar 1997--31 Dec 1999.

"Measuring the transfer, dynamics, and risk of invasion for microbial communities associated with the ballast water of ships." Maryland Sea Grant, $41,472, 1 Feb 1998--31 Jan 2000.

Other Sponsored Science & Technology--Burdige:

"Colored Dissolved Organic Matter in Sediments and Seagrass Beds and its Impact on Shallow Water Benthic Optical Properties." Office of Naval Research, $316,171; 10/1/96 - 9/30/99.

"Interactions Among Chemical Speciation, Algal Accumulation, and Sediment-Water Cycling of Toxic Metals in a Major US Naval Harbor (Elizabeth River, VA)" (J.R. Donat and DJB Co-PI's). Office of Naval Research, $375,000. 1/1/99 - 12/31/01.